SB761
U7R62
#27

c 85-268

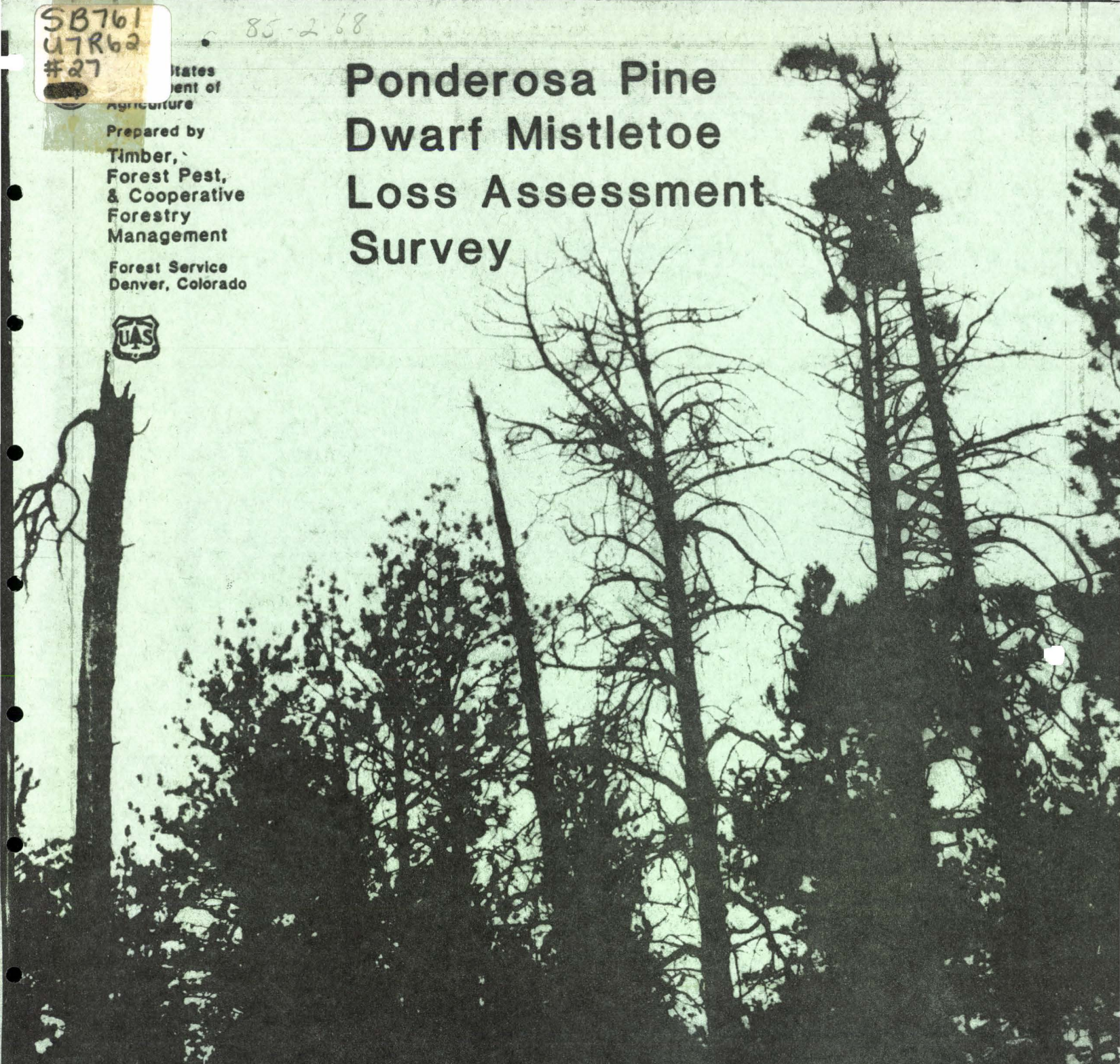
United States
Department of
Agriculture

Prepared by

Timber,
Forest Pest,
& Cooperative
Forestry
Management

Forest Service
Denver, Colorado

Ponderosa Pine Dwarf Mistletoe Loss Assessment Survey



LIBRARY
MAY 01984
ROCKY MOUNTAIN STATION

Ponderosa Pine Dwarf Mistletoe Loss Assessment Survey on National Forest Lands in Colorado

David W. Johnson, Frank G. Hawksworth, and Laura M. Merrill[1]

Technical Report R2-27

February 1984

Timber, Forest Pest, and
Cooperative Forestry Management
Rocky Mountain Region
USDA Forest Service
11177 W. 8th Avenue
Lakewood, CO 80225

---

[1] Supervisory Plant Pathologist, USDA Forest Service, Rocky Mountain Region, Lakewood, CO; Supervisory Forest Pathologist, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO; and Plant Pathologist, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, now with USDA Forest Service, North Central Forest Experiment Station, Carbondale, Ill.

ABSTRACT

During 1981-82, a roadside/plot survey was conducted on National Forest lands in Colorado to estimate annual merchantable cubic-foot volume loss caused by ponderosa pine dwarf mistletoe in ponderosa pine. This survey indicated that 18 percent of the type was infested. The total annual loss of ponderosa pine to dwarf mistletoe is estimated at 885,000 cubic feet. This loss is equivalent to 57 percent of the 1981 annual harvest of ponderosa pine for the Forests surveyed.

INTRODUCTION

During 1981-82, surveys were conducted on National Forest lands in Colorado to estimate annual merchantable cubic-foot volume loss caused by ponderosa pine dwarf mistletoe, *Arceuthobium vaginatum* subspecies *cryptopodum* (Engelm.) Hawksworth & Wiens, in ponderosa pine, *Pinus ponderosa* Laws.

This mistletoe occurs throughout the range of ponderosa pine in Colorado except north of Prairie Divide in the Roosevelt National Forest (Figure 1). This mistletoe does not occur in Nebraska, South Dakota, or Wyoming, in Region Two, thus the survey was limited to Colorado.

METHODS

National Forests surveyed included: the Arapaho and Roosevelt; the Grand Mesa, Uncompahgre, and Gunnison; the Pike and San Isabel; and the San Juan.

The survey was conducted in two stages, the first consisting of a roadside reconnaissance, the second, a series of variable-radius plots located at predetermined intervals along roads through ponderosa pine type. This survey design is similar to that used for lodgepole pine (Johnson et al. 1981) and has recently been evaluated in ponderosa pine (Merrill et al. 1984). Survey crews drove the majority of passable roads through the ponderosa pine type at speeds less than 10 miles per hour. Trees were observed to a distance of one-chain into the forest parallel to the right side of the road.

Only stands with at least 25 trees per acre (= ca. 20 trees per 0.1 mile) were recorded. Mileage was recorded to the nearest 0.1 mile whenever a change in timber type, size class, or dwarf mistletoe infection intensity was noted. This represented a sampling intensity of approximately 1.4 percent of the ponderosa pine type. The criteria for the road reconnaissance were:

Ponderosa pine type - more than 50 percent of the trees in the stand were ponderosa pine.

Size class - based on the estimated diameter of trees in the stand.

Pole = trees 5 to 9 inches dbh

Mature = trees greater than 9 inches dbh

Infection intensity:
- 0 = no infection
- 1 = less than one-third of the trees infected
- 2 = one-third to two-thirds of the trees infected
- 3 = greater than two-thirds of the trees infected

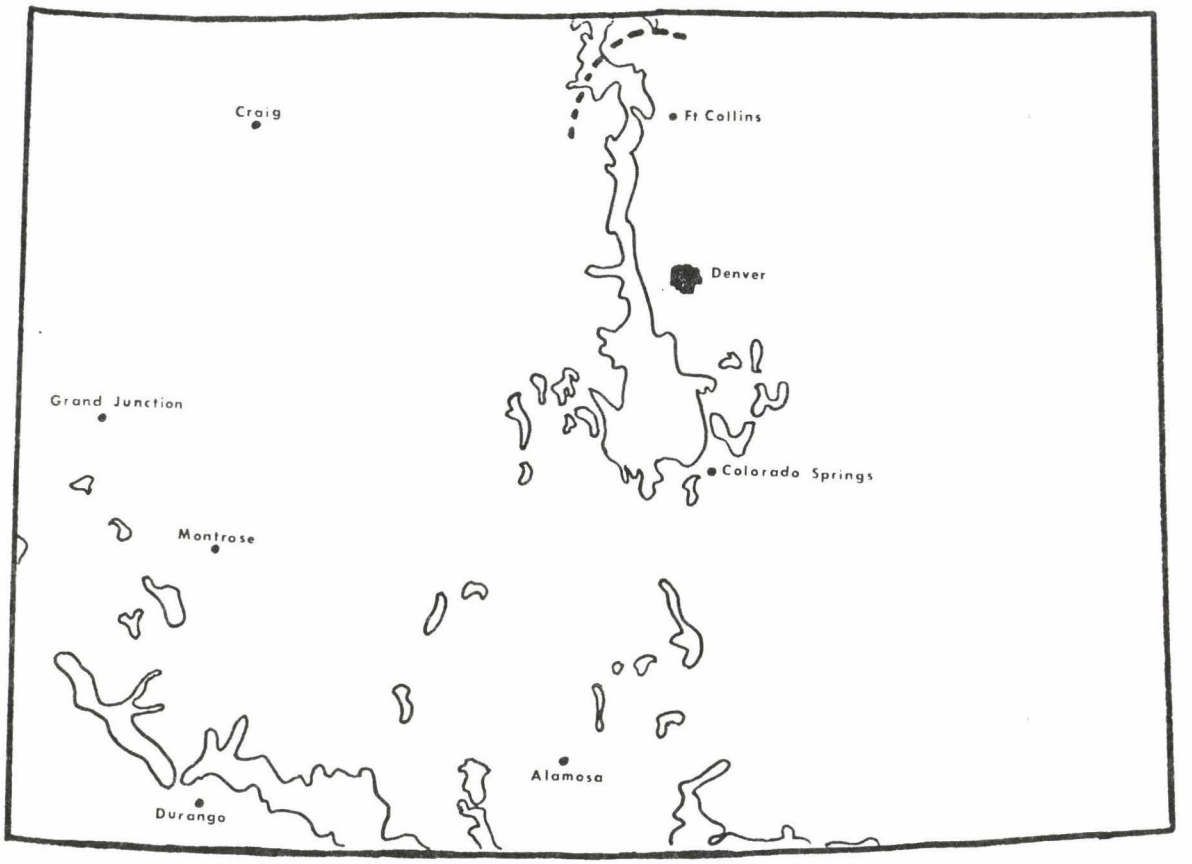


Figure 1. Distribution of ponderosa pine type in Colorado. Dwarf mistletoe occurs in all areas south of the dashed line, north of Fort Collins.

Crews established a variable-radius plot (basal area factor [BAF] 10) two chains into the stand every three miles on the right side of the road. If that location was non-type, the plot was placed on the left side of the road. If both locations were non-type, the plot was discarded without replacement. Diameter at breast height and dwarf mistletoe rating (DMR) (Hawksworth 1977) were recorded for all ponderosa pine greater than 4.9 inches dbh. The age of one representative tree on or near each plot was estimated from an increment core and used in calculating site index (Meyer, 1961) and producing yield tables. Data on reproduction (trees $\leq$ 4.9 inches dbh) were recorded using a 0.01 acre circular plot with the center superimposed on the variable radius plot.

Roadside reconnaissance data were used to estimate the proportion of ponderosa pine type infested with dwarf mistletoe. This was done by determining the ratio of the number of miles traveled adjacent to infested stands to the total miles traveled adjacent to ponderosa pine type.

The Rocky Mountain Yield Simulation Model (RMYLD) (Edminster 1978) was used to estimate merchantable cubic-foot volume loss in ponderosa pine from dwarf mistletoe. Plots were required to have a minimum BA of 20 to be included in the projections. The average DMR for each plot was used to determine growth loss and mortality over time. Since mistletoe infestations in the seedling-sapling size class have no effect on present yield, only data from pole- and sawtimber-size plots were used. Loss estimates were derived by making two consecutive runs of the model, the first using the average DMR for each plot and the second with the plot DMR converted to zero to represent non-infested stands. The former, estimating yield with dwarf mistletoe present, was subtracted from the latter which simulated growth for all stands over the next decade as if no dwarf mistletoe were present. Resulting values were divided by 10 to obtain an estimate of annual loss. This technique gives an underestimate of losses because it does not account for volume losses prior to the projection period.

Estimates of the number of acres of commercial size ponderosa pine type for each National Forest were obtained from the 1979 RPA tables for the Rocky Mountain Region. Only acres of pole- and sawtimber-size classes were used as no current merchantable volume loss in seedling or sapling size stands will occur. Future loss of volume due to dwarf mistletoe in these stands was not considered in this assessment.

RESULTS

This survey indicated that 18.2 percent of the 1094 miles traversed within ponderosa pine type were adjacent to mistletoe infested stands (Table 1). Disease incidence was greatest on the San Juan National Forest where 20.9 percent of miles driven were adjacent to infested stands and lowest on the Grand Mesa, Uncompahgre and Gunnison National Forests with 4.2 percent.

Estimates of annual merchantable cubic-foot volume loss for all Forests are summarized in Table 2. Detailed data for each Forest are presented in Tables 3-6 in the Appendix. The Pike and San Isabel National Forest had the greatest estimated annual loss, 460.6 M cubic feet. No measureable loss was recorded on the Grand Mesa, Uncompahgre and Gunnison National Forests since only one infested plot was recorded and the DMR was so low, no volume effect was calculated (Table 4). This is unrealistic and is due to the low sampling intensity.

The total annual loss of ponderosa pine to dwarf mistletoe for all Colorado National Forests is estimated at over 885 M cubic feet (Table 2). This loss is equivalent to 57 percent of the annual harvest of ponderosa pine for these Forests in fiscal year 1981.

This current estimate of loss is about one tenth that of the previous loss estimate reported by Drummond (1982). Reasons for the reduced estimate include (1) Drummond's (1982) loss figure for ponderosa pine was estimated from lodgepole pine losses, whereas in this survey actual measurements were made in ponderosa pine stands; (2) reduction in the area of commercial ponderosa pine forest since the earlier survey, primarily because of withdrawals from commercial forest land base; (3) lower loss estimates per acre; and (4) lower estimates of the percentage of the ponderosa pine type infested by dwarf mistletoe. This current loss estimate is considered conservative and will be refined in the future.

Recent inventories (Green and Van Hooser, 1983) indicate that there are 190,000 acres of non-National Forest commercial ponderosa pine (poles and sawtimber) in Colorado. If it is assumed that dwarf mistletoe losses are comparable to that occurring on National Forest lands, then the total loss for commercial ponderosa pine forests would be about 1.15 million cubic feet per year.

Table 1. Miles of road traveled within ponderosa pine type and incidence of *Arceuthobium vaginatum* subspecies *cryptopodum* listed by National Forests in Colorado.

National Forest	Miles surveyed within type	Miles adjacent to infested stands	% Adjacent to infested stands
Arapaho and Roosevelt	268	50	18.6
Grand Mesa, Uncompahgre, and Gunnison	119	5	4.2
Pike and San Isabel	372	74	19.9
San Juan	335	70	20.9
Totals	1094	199	18.2

Table 2. Estimates of merchantable volume loss due to dwarf mistletoe in ponderosa pine stands on National Forest lands in Colorado.

National Forest	Commercial host type (M acres)[1]	Infested acres		Total merchantable volume loss (M cu ft/yr)[4]	Merchantable volume loss[5] (cu ft/A/yr)
		%[2]	(M) No.[3]		
Arapaho and Roosevelt	99.9	18.6	18.1	151.6	8.4
Grand Mesa, Uncompahgre and Gunnison	77.0	4.2	3.0	0.0	0.0
Pike and San Isabel	260.5	19.9	53.4	460.6	8.6
San Juan	190.3	20.9	45.5	272.6	6.0
Totals	627.7	18.2	120.0	884.8	---

1 From 1979 RPA tables (pole- and sawtimber-size stands only).

2 From road survey (1981-82).

3 Derived from Columns 1 and 2.

4 Plot data.

5 $\frac{\text{Total merchantable volume loss}}{\text{Acres infested}}$

LITERATURE CITED

Drummond, D. B. 1982. Timber loss estimates for the coniferous forests of the United States due to dwarf mistletoes. USDA For. Serv. Forest Pest Mgmt. Methods Application Group Rep. 83-2. 24 p.

Edminster, C. B. 1978. RMYLD: Computation of yield tables for even-aged and 2-aged stands. USDA For. Serv., Rocky Mtn. For. and Range Exp. Sta. Res. Pap. RM-199. 26 pp.

Green, A. W., and D. D. Van Hooser. 1983. Forest resources of the Rocky Mountain States. USDA For. Serv., Intermountain For. and Range Exp. Sta. Resour. Bull. INT-33. 127 p.

Hawksworth, F. G. 1977. The 6-class dwarf mistletoe rating system. USDA For. Serv., Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. 48. 7 pp.

Johnson, D. W., F. G. Hawksworth, and D. B. Drummond. 1981. Yield loss of lodgepole pine stands to dwarf mistletoe in Colorado and Wyoming National Forests. Plant Disease 65:437-438.

Merrill, L. M., F. G. Hawksworth, and D. W. Johnson. 1984. Evaluation of a dwarf mistletoe roadside procedure in Colorado ponderosa pine. Plant Disease 68 (IN PRESS).

Meyer, W. H. 1961. Yield of even-aged stands of ponderosa pine. USDA Tech. Bull. 630, 59 p. (Revised).

Table 3. Acres of dwarf mistletoe infestation represented by survey plots and merchantable annual cubic-foot volume loss estimates for the Arapaho and Roosevelt National Forest ponderosa pine stands listed by dwarf mistletoe severity categories.

Dwarf mistletoe severity category[1]	No. plots	% representation	M acres [2,3]	Merchantable volume loss (cu ft/A/yr)	Total merchantable vol. loss/yr (M cu ft)
0	88	83.8	83.707	0.0	0.0
0.1 - 0.5	3	2.9	2.897	0.0	0.0
0.6 - 1.4	6	5.7	5.694	1.7	9.680
1.5 - 6.0	8	7.6	7.592	18.7	141.970
Totals	105	100.0	99.890	--	151.650

1 Dwarf mistletoe severity categories were chosen to approximate the percentages of trees infected in the three roadside categories (less than one-third, one-third to two thirds, and more than two-thirds of the trees infected, respectively).

2 Acres of type from 1979 RPA tables.

3 Acres for each category shown in column 4 = % shown in column 3 X 9.99 M acres.

Table 4. Acres of dwarf mistletoe infestation represented by survey plots and merchantable annual cubic-foot volume loss estimates for the Grand Mesa, Uncompahgre and Gunnison National Forests ponderosa pine stands listed by dwarf mistletoe severity categories.

Dwarf mistletoe severity category [1]	No. plots	% representation	M acres [2,3]	Merchantable volume loss (cu ft/A/yr)	Total merchantable vol. loss/yr (M cu ft)
0	29	96.7	74.459	0.0	0.0
0.1 - 0.5	1	3.3	2.541	0.0	0.0
0.6 - 1.4	0	0.0	0.0	0.0	0.0
1.5 - 6.0	0	0.0	0.0	0.0	0.0
Totals	30	100.0	77.000	--	0.0

1 Dwarf mistletoe severity categories were chosen to approximate the percentages of trees infected in the three roadside categories (less than one-third, one-third to two-thirds, and more than two-thirds of the trees infected, respectively).

2 Acres of type from 1979 RPA tables.

3 Acres for each category shown in column 4 = % shown in column 3 X 77.0 M acres.

Table 5. Acres of dwarf mistletoe infestation represented by survey plots and merchantable annual cubic-foot volume loss estimates for the Pike and San Isabel National Forests ponderosa pine stands listed by dwarf mistletoe severity categories.

Dwarf mistletoe severity category [1]	No. plots	% representation	M acres[2,3]	Merchantable volume loss (cu ft/A/yr)	Total merchantable vol. loss/yr (M cu ft)
0	150	81.5	212.323	0.0	0.0
0.1 - 0.5	8	4.3	11.202	0.0	0.0
0.6 - 1.4	13	7.1	18.497	3.7	68.439
1.5 - 6.0	13	7.1	18.497	21.2	392.136
Totals	184	100.0	260.519	--	460.575

1 Dwarf mistletoe severity categories were chosen to approximate the percentages of trees infected in the three roadside categories (less than one-third, one-third to two-thirds, and more than two-thirds of the trees infected, respectively).

2 Acres of type from 1979 RPA tables.

3 Acres for each category shown in column 4 = % shown in column 3 X 260.5 M acres.

Table 6. Acres of dwarf mistletoe infestation represented by survey plots and merchantable annual cubic-foot volume loss estimates for the San Juan National Forest ponderosa pine stands listed by dwarf mistletoe severity categories.

Dwarf mistletoe severity category [1]	No. plots	% representation	M acres [2,3]	Merchantable volume loss (cu ft/A/yr)	Total merchantable vol. loss/yr (M cu ft)
0	173	71.5	136.066	0.0	0.0
0.1 - 0.5	22	9.1	17.317	0.0	0.0
0.6 - 1.4	25	10.3	19.601	2.6	50.963
1.5 - 6.0	22	9.1	17.317	12.8	221.658
Totals	242	100.0	190.302	--	272.621

1 Dwarf mistletoe severity categories were chosen to approximate the percentages of trees infected in the three roadside categories (less than one-third, one-third to two-thirds, and more than two-thirds of the trees infected, respectively).

2 Acres of type from 1979 RPA tables.

3 Acres for each category shown in column 4 = % shown in column 3 X 190.3 M acres.